

Claims: I claim:

1. An ultra fast display cell structure comprising:
 - a. a super thin inner cell spacing;
 - b. a twisted nematic liquid crystal film with low viscosity, high optical anisotropy, low dielectric anisotropy and small helical pitch;
 - c. a passive electronic driving circuitry with a waveform of ultra high frame-rate;

wherein the liquid crystal film filled into the cell spacing is satisfied substantially with a super twisted angular and optical configurations; and the high frame rate driving waveform is satisfied substantially with the rms addressing requirement of the ultra fast display cell structure;

whereby a video speed display with high contrast ratio is formed.
2. The display as in claim 1 wherein the super thin inner cell spacing is a cell gap with the thickness of $2 \sim 5 \mu\text{m}$, more preferably, $3 \sim 4 \mu\text{m}$.
3. The display as in claim 1 wherein the high optical anisotropy is an optical birefringence, Δn , with a value of $0.2 \sim 0.3$, more preferably, $0.23 \sim 0.27$.
4. The display as in claim 1 wherein the low dielectric anisotropy, $\Delta\epsilon$, is in the range of $2 \sim 8$ which results in high display contrast ratio.
5. The display as in claim 1 wherein the small helical pitch, p_0 , is in the range of $5 \sim 8$ which results in fast restoring time.
6. The display as in claim 1 wherein the ultra high frame rate is the frame rate at least 120 Hz, which is two times higher than the normal frame rate of the STN display.
7. The display as in claim 1 wherein the video speed is at least 30 frames per second.
8. A liquid crystal characteristics for video rate STN display comprising:
 - a. low viscosity;
 - b. high optical birefringence;
 - c. high threshold voltage;
 - d. small helical pitch;
 - e. low dielectric anisotropy;

wherein low viscosity and small helical pitch is for fast response time, high optical birefringence is for the optimal retardation at a thin cell gap and high threshold voltage and low dielectric anisotropy are for the high contrast ratio; whereby the liquid crystal ensures the video speed display while maintaining high contrast ratio.

9. The liquid crystal characteristics as in claim 8 wherein the viscosity is in the range of 15 ~ 25cp at 20⁰C.
10. The liquid crystal characteristics as in claim 8 wherein the high optical birefringence, Δn , is in the range of 0.2 ~ 0.3, more preferably, 0.23 ~ 0.27.
11. The liquid crystal characteristics as in claim 8 wherein the low dielectric anisotropy, $\Delta\epsilon$, is in the range of 2 ~ 8 which results in high display contrast ratio.
12. The liquid crystal characteristics as in claim 8 wherein the small helical pitch, p_0 , is in a range of 5 ~ 8.
13. The liquid crystal characteristics as in claim 8 wherein the high contrast ratio is larger than 40:1.
14. An electronic driving circuitry for the video speed STN display comprising:
 - a. a row driver with high frequency response;
 - b. a column driver with superior output capability;
 - c. a controller which generate a high frame rate pulses for both row and column drivers through a synchronizing signal;
 - d. a high frequency frame inverting circuit to change the polarity of the waveform for off-setting the DC component of the accumulate waveforms;
 whereby a high frame rate waveform is generated for the video speed STN display.
15. The electronic driving circuitry as in claim 14 where the row driver with high frequency response ensures substantially no horizontal cross talk at high frame rate.
16. The electronic driving circuitry as in claim 14 where the column driver with superior output capability ensures substantially no vertical cross talk at high frame rate.
17. The electronic driving circuitry as in claim 14 where the high frame rate is at least 120 Hz, which is two times more than the prior art.

18. The electronic driving circuitry as in claim 14 where the high frame rate ensures substantially flicker-free display result.
19. The electronic driving circuitry as in claim 14 where the high frame rate ensures substantially no frame response.
20. The electronic driving circuitry for the video speed STN display ensures at least 30 frames of images per second without substantial signal distortion.